

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶ :H02K 7/10, 21/22, B65G 23/08, B65H
27/00

A1

(11) International Publication Number:

WO 99/65134

(43) International Publication Date: 16 December 1999 (16.12.99)

(21) International Application Number: PCT/US99/13145

(22) International Filing Date: 11 June 1999 (11.06.99)

(30) Priority Data:

60/088,856	11 June 1998 (11.06.98)	US
09/166,139	2 October 1998 (02.10.98)	US

(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application

US	09/166,139 (CIP)
Filed on	2 October 1998 (02.10.98)

(71) Applicant (for all designated States except US): ASPEN MOTION TECHNOLOGIES, INC. [US/US]; 1120 Rock Road, Radford, VA 24141 (US).

(72) Inventors; and

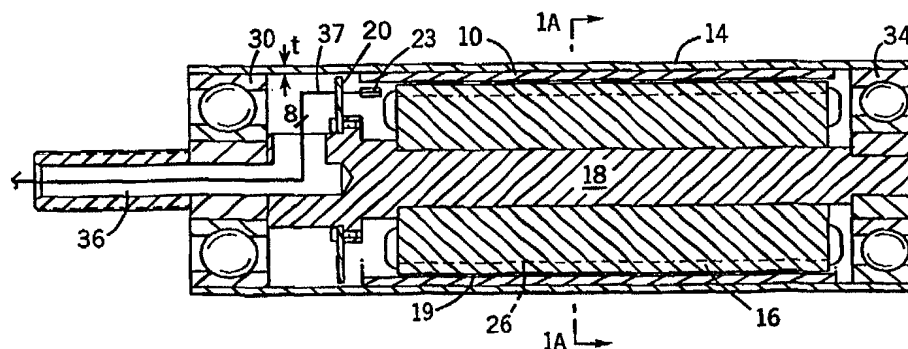
(75) Inventors/Applicants (for US only): BARANI, Moe, K. [US/US]; 104 Mountain View Lane, Radford, VA 24141 (US). FLANARY, Ron [US/US]; 295 Deercroft Drive, Blacksburg, VA 24060 (US). SNIDER, Lee [US/US]; 3635 Fairview Church Road, Christiansburg, VA 24074 (US).

(74) Agents: MCGOVERN, Michael, J. et al.; Quarles & Brady LLP, 411 East Wisconsin Avenue, Milwaukee, WI 53202-4497 (US).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published*With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: DIRECT DRIVE INSIDE-OUT BRUSHLESS ROLLER MOTOR

**(57) Abstract**

A brushless d.c. motor is integrated with a conveyor roller (14) by placing a plurality of stator coils (15) on a stationary shaft (18) and securing a rotor (10) with segments (12) of permanent magnetic material to the inside of the conveyor roller (14). In one embodiment the rotor (10) is directly secured to the roller while in a second embodiment, the rotor (10) is disposed inside of a cylindrical metal housing (40) that is press fit inside of the roller. Commutation is provided by an external motor controller (54) which is connected by conductors (37) through a passageway (36) in the shaft (18) to a circuit board (20), where sensors (23) are mounted to sense rotor position for purposes of commutation of the stator coils (15).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No.	International filing date (day/month/year)	(Earliest) Priority Date (day/month/year)
PCT/US 99/ 13145	11/06/1999	11/06/1998
Applicant		
ASPEN MOTION TECHNOLOGIES, INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 99/13145

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H02K7/10 H02K21/22 B65G23/08 B65H27/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B65G H02K E06B D01H G03G B41F B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	US 5 918 728 A (SYVERSON) 6 July 1999 (1999-07-06) abstract column 3, line 2 -column 4, line 8; figure 1	1-7, 10
P, X	US 5 852 897 A (SUKALE) 29 December 1998 (1998-12-29) abstract column 2, line 36-62; figure 2	1, 2, 4-7, 10
X	& WO 98 04801 A (INVENTIO AG)	1, 2, 4-7, 10
	--- -/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

30 September 1999

Date of mailing of the international search report

07/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Beitner, M

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 99/13145

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 524 805 A (SHIBA ET AL.) 11 June 1996 (1996-06-11) abstract column 4, line 1-16 column 4, line 30-42 column 6, line 17-40 column 6, line 62 -column 7, line 40; figures 1,2,4-6 ---	1,2,4,7, 10
X	DE 298 02 297 U (MAN ROLAND DRUCKMASCHINEN AG) 16 April 1998 (1998-04-16) the whole document ---	1,4,5,7, 10
X	PATENT ABSTRACTS OF JAPAN vol. 16, no. 459 (E-1268), 24 September 1992 (1992-09-24) & JP 04 161050 A (TOKYO ELECTRIC CO LTD), 24 June 1992 (1992-06-24) abstract ---	1,4-7
X	US 5 145 169 A (KATO) 8 September 1992 (1992-09-08) column 2, line 41 -column 3, line 14 column 3, line 25-56; figure 1 ---	1,2,4,5, 7
X	DE 24 34 220 A (SIEMENS AG) 29 January 1976 (1976-01-29) the whole document ---	1-5,7
A	DE 39 41 823 C (ZINSER TEXTILMASCHINEN GMBH) 8 May 1991 (1991-05-08) column 1, line 61 -column 2, line 38; figure 1 ---	1,4,7
A	US 4 116 397 A (BURGBACHER) 26 September 1978 (1978-09-26) abstract column 5, line 61 -column 6, line 23; figures 2,4 ---	1,4,5,7
A	US 5 030 864 A (VAN HOUT ET AL.) 9 July 1991 (1991-07-09) abstract column 3, line 34 -column 4, line 2; figures 1,2 -----	6,9

INTERNATIONAL SEARCH REPORT



Information on patent family members



International Application No

PCT/US 99/13145

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5918728	A	06-07-1999	NONE		
US 5852897	A	29-12-1998	AU	3252497 A	20-02-1998
			CA	2259933 A	05-02-1998
			WO	9804801 A	05-02-1998
			EP	0914537 A	12-05-1999
US 5524805	A	11-06-1996	JP	1313247 A	18-12-1989
			JP	2592422 B	19-03-1997
			JP	2013559 A	17-01-1990
			JP	2073340 C	25-07-1996
			JP	7094300 B	11-10-1995
			DE	3919291 A	21-12-1989
DE 29802297	U	16-04-1998	EP	0936723 A	18-08-1999
JP 04161050	A	04-06-1992	NONE		
US 5145169	A	08-09-1992	DE	69017824 D	20-04-1995
			DE	69017824 T	13-07-1995
			EP	0422874 A	17-04-1991
DE 2434220	A	29-01-1976	NONE		
DE 3941823	C	08-05-1991	DE	3943560 A	05-09-1991
US 4116397	A	26-09-1978	DE	2360900 A	26-06-1975
US 5030864	A	09-07-1991	NL	8801700 A	01-02-1990
			DE	3921725 A	11-01-1990
			FR	2635927 A	02-03-1990
			GB	2220529 A, B	10-01-1990

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/13145

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 524 805 A (SHIBA ET AL.) 11 June 1996 (1996-06-11) abstract column 4, line 1-16 column 4, line 30-42 column 6, line 17-40 column 6, line 62 -column 7, line 40; figures 1,2,4-6	1,2,4,7, 10
X	DE 298 02 297 U (MAN ROLAND DRUCKMASCHINEN AG) 16 April 1998 (1998-04-16) the whole document	1,4,5,7, 10
X	PATENT ABSTRACTS OF JAPAN vol. 16, no. 459 (E-1268), 24 September 1992 (1992-09-24) & JP 04 161050 A (TOKYO ELECTRIC CO LTD), 24 June 1992 (1992-06-24) abstract	1,4-7
X	US 5 145 169 A (KATO) 8 September 1992 (1992-09-08) column 2, line 41 -column 3, line 14 column 3, line 25-56; figure 1	1,2,4,5, 7
X	DE 24 34 220 A (SIEMENS AG) 29 January 1976 (1976-01-29) the whole document	1-5,7
A	DE 39 41 823 C (ZINSER TEXTILMASCHINEN GMBH) 8 May 1991 (1991-05-08) column 1, line 61 -column 2, line 38; figure 1	1,4,7
A	US 4 116 397 A (BURGBACHER) 26 September 1978 (1978-09-26) abstract column 5, line 61 -column 6, line 23; figures 2,4	1,4,5,7
A	US 5 030 864 A (VAN HOUT ET AL.) 9 July 1991 (1991-07-09) abstract column 3, line 34 -column 4, line 2; figures 1,2	6,9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/13145

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5918728	A	06-07-1999	NONE	
US 5852897	A	29-12-1998	AU 3252497 A CA 2259933 A WO 9804801 A EP 0914537 A	20-02-1998 05-02-1998 05-02-1998 12-05-1999
US 5524805	A	11-06-1996	JP 1313247 A JP 2592422 B JP 2013559 A JP 2073340 C JP 7094300 B DE 3919291 A	18-12-1989 19-03-1997 17-01-1990 25-07-1996 11-10-1995 21-12-1989
DE 29802297	U	16-04-1998	EP 0936723 A	18-08-1999
JP 04161050	A	04-06-1992	NONE	
US 5145169	A	08-09-1992	DE 69017824 D DE 69017824 T EP 0422874 A	20-04-1995 13-07-1995 17-04-1991
DE 2434220	A	29-01-1976	NONE	
DE 3941823	C	08-05-1991	DE 3943560 A	05-09-1991
US 4116397	A	26-09-1978	DE 2360900 A	26-06-1975
US 5030864	A	09-07-1991	NL 8801700 A DE 3921725 A FR 2635927 A GB 2220529 A,B	01-02-1990 11-01-1990 02-03-1990 10-01-1990

INTERNATIONAL SEARCH REPORT

Inter national Application No
PCT/US 99/13145

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H02K7/10 H02K21/22 B65G23/08 B65H27/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65G H02K E06B D01H G03G B41F B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	US 5 918 728 A (SYVERSON) 6 July 1999 (1999-07-06) abstract column 3, line 2 -column 4, line 8; figure 1	1-7,10
P,X	US 5 852 897 A (SUKALE) 29 December 1998 (1998-12-29) abstract column 2, line 36-62; figure 2	1,2,4-7,10
X	& WO 98 04801 A (INVENTIO AG)	1,2,4-7,10



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

30 September 1999

Date of mailing of the international search report

07/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

Beitner, M